

Bushmeat trade in Kisangani (DRC), Constancy and Abundance of Mammalian Species on the Market from 1976 to 2016

Commercialisation de la viande de brousse à Kisangani (RDC), constance et abondance des espèces mammaliennes sur le marché de 1976 à 2016

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Abstract— Bushmeat is regularly sold and be consumed in Kisangani. The copulated data show not only very high occurrences but also species composition changes year after year, few of them remain constant in the market. This implies that monitoring activities must be developed in this sector. Kisangani region is experiencing an erosion of its biodiversity due to the bushmeat trade. A significant proportion of the specimens of meat marketed is protected species near 8.44%. Colobuses, water snakes and elephants are the most commercially protected species on the market for commercialized game. The analysis of data copulated over the period from 1976 to 2016 reveals an estimated occurrence of 118090 specimens sold whose constant species frequencies higher than 50%, are listed as follows:

Primates include *Cercopithecus ascanius*, *Cercopithecus hamlyni*, *Cercopithecus hoesti*, *Cercopithecus mitis*, *Cercopithecus neglectus*, *Cercopithecus mona*, *Colobus angolensis*, *Lophocebus albigena*, *Papio anubis* and *Piliocolobus badius*.

For Artiodactyla, *Philantomba monticola*, *Cephalophus dorsalis*, *Cephalophus nigrifrons*, *Cephalophus sylvicultor*, *Hyemoscus aquaticus*, *Tragelaphus spekei*, *Potamochoerus porcus*.

For Rodents, it concerns *Atherurus africanus*, *Cricetomys emini*.

The remaining species are either incidental or accidental.

From the relative abundance point of view in Primates, *Cercopithecus ascanius* 26.73%, *Cercopithecus mitis* 6.68%, *Cercopithecus hoesti* 6.3%, *Colobus angolensis* 4.3%, *Procolobus badius* 6%.

In the Artiodactyla, *Philantomba monticola* predominates with 54.4%, *Cephalophus dorsalis* 11.7%, 5.06%, *Cephalophus nigrifrons* 5.99%.

For Rodents, *Cricetomys emini* predominates with 57.59%, *Atherurus africanus* 21.44%, *Cricetomys gambianus* 20.48%

Others animals groups trade are giant pangolin *Smutsia gigantea* 90.13%, *Dendrohyrax dorsalis* 64.88%, *Orycteropus afer* 37.5%, *Osbornictis piscivora* 73.21%, *Bdeogale nigripes* 26.62%, and finally *Eidolon helvum* for Bats 76, 9%.

Keywords— Bushmeat trade, species constancy, species abundance, status of exploited species, Kisangani.

Résumé— La viande de brousse est régulièrement vendue et consommée à Kisangani. Les données copulées montrent non seulement des occurrences très élevées mais aussi la composition des espèces change d'année en année, peu d'entre elles restent constantes sur le marché. Ce qui implique que des activités de surveillance doivent être développées dans ce secteur. La région de Kisangani connaît une érosion de sa biodiversité due au commerce de la viande de brousse. Une proportion non négligeable des spécimens commercialisés est constituée d'espèces protégées soit 8,44%. Les Colobes, les chevrotiens aquatiques et les éléphants sont les espèces protégées les plus inventoriées au marché parmi le gibier commercialisé.

L'analyse des données copulées sur la période allant de 1976 à 2016 révèle une occurrence estimée à 118090 individus vendues dont les espèces constantes c'est-à-dire à fréquence supérieure à 50% se listent comme suit :

Pour les Primates, il s'agit de *Cercopithecus ascanius*, *Cercopithecus hamlyni*, *Cercopithecus l'hoesti*, *Cercopithecus mitis*, *Cercopithecus neglectus*, *Cercopithecus mona*, *Colobus angolensis*, *Lophocebus albigena*, *Papio anubis*, *Ptilocolobus badius*.

Pour les Artiodactyles, *Philantomba monticola*, *Cephalophus dorsalis*, *Cephalophus nigrifrons*, *Cephalophus sylvicultor*, *Hyemoscus aquaticus*, *Tragelaphus spekei*, *Potamochoerus porcus*.

Pour les Rongeurs, *Atherurus africanus*, *Cricetomys emini*.

Les espèces restantes sont soit accessoires soit accidentelles.

Du point de vue d'abondance relative chez les Primates, il s'agit de *Cercopithecus ascanius* 26,73%, *Cercopithecus mitis* 6,68%, *Cercopithecus hoesti* 6,3%, *Colobus angolensis* 4,3%, *Procolobus badius* 6%.

Pour les Artiodactyles, *Philantomba monticola* prédomine avec 54,4%, *Cephalophus dorsalis* 11,7%, *Potamochoerus porcus* 5,06%, *Cephalophus nigrifrons* 5,99%.

Pour les Rongeurs, *Cricetomys emini* prédomine avec 57,59%, *Atherurus africanus* 21,44%, *Cricetomys gambianus* 20,48%.

Les autres groupes d'animaux commercialisés sont entre autre le pangolin géant *Smutsia gigantea* 90,13%, *Dendrohyrax dorsalis* 64,88%, *Orycteropus afer* 37,5%, *Osbornictis piscivora* 73,21%, *Bdeogale nigripes* 26,62%, et enfin les Chiroptères *Eidolon helvum* avec 76,9%.

Mots clés — Ressources naturelles, commerce, viande de brousse, constance, abondance, statut des espèces, Kisangani.

I. INTRODUCTION

The diversity and the biological wealth of the DRC are not to be demonstrated nowadays. Indeed, the geo climatic position of the Congo confers on him various advantages among others a great potentiality in wild fauna starting with the smallest animals until large mammals. The DRC has the privilege of counting on its territory magnificent national parks, hunting grounds and a large number of forest reserves allowing a big industry starting from the wildlife, industry which would intervene positively in the economy of the country if we became aware of it.

The major problem or challenge for this beautiful and large country is rational and sustainable exploitation of resources. The daily survival of many forest households is highly dependent on natural resources (Delvingt 2001, De Merode *et al.*, 2011, Valimahamed, 2014, Consolate *et al.*, 2016, 2017 and 2018, Musaba, 2018). Concerning the exploitation of game animals, the review of the existing literature shows the existence of a serious problem of management of wild herds. Hunting as practiced in the Kisangani region is far from rational, thus causing wildlife erosion (Feer 1996, Kabongo 2005, Van Vliet *et al.*, 2012).

Examination of different aspects of the hunting activity of the region states, it does not operate in accordance with ecological principles relating to animal production and the exploitation of ecosystems. It does not also obey the standards of the existing regulations. The pace and the manner in which the current samples are taken do not guarantee durability. Since we must act upstream and downstream to save the situation, all stakeholders must change their way of doing and living: consumers, traders, managers; hunters in particular must behave as cautious

and intelligent predators. They must know how to limit, select their samples while maintaining the diversity and structure of animal populations that condition the balance of ecosystems.

Two fundamental questions were asked:

What is the constancy and abundance of the regularly sold species in the different urban and rural markets of the city of Kisangani from 1976 to 2016?

Secondly, taking into account the law on hunting in the country, what is the proportion of protected species in game markets in Kisangani?

II. BACKGROUND AND RATIONALE FOR THE STUDY

Like other regions of the Congo Basin, the exploitation of forest resources is a major activity in the Kisangani region. Bushmeat marketing and consumption studies began in 1976. On-site realities changed because of population growth, deforestation, and disturbance of wildlife habitat in a variety of ways (Delvingt 2001, De Merode, 1998, 2004, Mbete *et al.*, 2011, Van Vliet and Mbazza, 2011, Valimahamed, 2014, Consolate *et al.*, 2017 and 2018, Musaba, 2018). This study assesses the regularity of the species on the market in the face of the growing demand for meaty foods as well as the increasing hunting pressure in the country.

Globally, the study aims to gather data on bushmeat harvesting in the Kisangani Forest Region from 1976 to 2016 to monitor and report on the status of this resource, which is highly valued by urban-rural populations. New approaches to monitoring biodiversity require the development of monitoring indicators that can be evaluated year-by-year in order to identify likely changes. Specifically, the study analyzes the evolution of the

market through a few indicators such as the regularity of species on the market, their abundance and their status.

Brief description of the study environment

The present Province of Tshopo resulting from the dismemberment of the Province Orientale is an entity which covers an area of 199 567 km², with a population estimated at approximately 2 614 630 inhabitants and a density of 9 inhabitants per km² (Nebesse, 2016). It is crossed in the middle by the equator; it goes from -2 ° South latitude to + 2 ° North latitude, about 400 km and 22 ° to 28 ° East longitude, about 600 km. Characterized by a warm and humid climate to which the dense equatorial forest corresponds, the hydrographic network is entirely of fresh water.

Wildlife is dependent on the environment in which it evolves. For her, vegetation is one of the most important environmental factors. It serves as habitat but is also a source of food. Dajoz (1982) states that with regard to dietary factors, vegetation plays a major role in the life of animals. For the quality, quantity and accessibility of the food it provides, it influences various parameters of wildlife populations such as fertility, longevity, speed of development, birth rate. The diversification of the diets, says the author, is at the origin of many morphological, physiological and ecological adaptations which are the witnesses of a long coevolution between the herbivores and the plants, between the predators and their preys (Dajoz, 1982).

The province of Tshopo is located in the middle of the Congolese central basin characterized by the hot and humid equatorial climate. It is an area of dense forests. Primary forests and secondary plant formations are distinguished.

There are three types of primitive plant formations:

- a) evergreen rainforests, two types: the forest with *Brachystegia laurentii* Germain (1960) is found on Lubutu, Opala and Yangambi roads. This exuberant formation is very widely represented in the region; and with *Gilbertiodendron dewevrei*.
- b) Guinean semi-deciduous forest mesophilic forests. They are climax forests characterized from the physiognomic point of view by a mixture of evergreen and deciduous species. Despite their heterogeneous nature, Lubini (1982) recognized two types: the forest dominated by *Scorodophloeus zenkeri* and the predominantly *Celtis* forest of various species.
- c) There are three types of edaphic forests linked to hydromorphic soils: riparian groups, riparian forests and swamp forests (Lubini, 1982).

The detailed study of the messicultural, segural and postcultural vegetation of the Tshopo administrative sub-regions was made by Lubini (1982). The author distinguishes four types of vegetations: adventitious vegetation of annual or perennial crops:

- Vegetation of grassy fallows
- Vegetation of fallow land and forest regrowth
- Secondary forest vegetation

In addition, protected areas and forest areas are remarkable habitats for wildlife (Mbete *et al.*, 2011). In this forest region, there are few breeding alternatives for the supply of animal protein, and hunting meat is an important source of protein in the diet of the people of the Congo Basin (Willcox and Nambu, 2007; Kumpel *et al.*, 2010). In fact, the populations of the Congo Basin have always practiced a customary hunting of self-subsistence. It occupies an important place in the economic and cultural organization of these forest companies (Agnagna 2001, Delvingt 2001).

III. METHODS

To achieve the objectives assigned to the study, the following steps were taken: the exploitation of research results available in libraries and on the internet about bushmeat in the Kisangani forest region (published articles, doctoral theses, DEA, Masters dissertations, non governmental organisation reports, field and laboratory notebooks). Relevant information and data on bushmeat available from 1976 to 2016 have been copied and processed through Excell 2016. Relative abundance (AR) per wildlife species sold is estimated by the formula

$$AR (\%) = nx100/N$$

We used Constance (C) to estimate the regularity with which a species is present on the market year. This Constance varies from 0 to 100%. It is calculated as follows:

$$C = \frac{\rho_i}{P} \times 100$$

Where pi indicates the number of times a species appears on the market in the year.

P: total number of appearances

=: Percentage

- If $C \geq 50\%$, C is in the range [50, 100], then the species is constant;
- If $25\% \leq C < 50\%$, C is in the range [25,50 [, then the species is incidental;
- If $C < 25\%$, C is in the range [0,25 [, then the species is accidental.

For all groups, the constancy was calculated taking into account eight columns (data) although for some there is no data.

IV. RESULTS

The following tables show the category of wildlife marketed in Kisangani, the authors who focused on the exploitation of game in Kisangani, from 1976 to 2016, and the annual inventoried specimens. We calculated the relative abundance (R.A) by species but also assessed the regularity of the species thanks to the copulated surveys.

Table.1: Commercialization of Primates in Kisangani

Species	Banamuhere	Wesi	Biya	Gambalemoke	Belombo	Sakananu	Nebesse	Nebesse	Kawera	Total	R.A (%)	Constancy(%)	Status
	1976	1981	1983	1989	1997	2006	2014	2016	2016				
<i>Cercopithecus ascanius</i> (Audebert, 1799)	154	715	915	467	204	845	284	2073	1129	6786	26,73	100	NP
<i>Cercopithecus hamlyni</i> <i>Pocock, 1907</i>	8	14	16	45	38	0	2	15	618	756	2,97	87,5	NP
<i>Cercopithecus Thoensti</i> <i>Clater, 1898</i>	6	84	72	103	71	5	56	930	297	1624	6,39	100	NP
<i>Cercopithecus mitis</i> <i>wolff, 1822</i>	41	221	242	232	69	372	104	61	355	1697	6,68	100	NP
<i>Cercopithecus neglectus</i> (Schelegel, 1876)	1	13	0	34	4	0	1	0	171	224	0,88	75	NP
<i>Cercopithecus nictitans</i> (Linnaeus, 1766)	0	0	0	0	0	0	0	9	444	453	1,78	12,5	NP
<i>Cercopithecus mona</i> <i>denti</i> (Thoma, 1907)	49	128	180	88	6	0	2	2	0	455	1,79	87,5	NP
<i>Cercopithecus wolff</i> (Meyer, 1891)	0	0	0	0	0	0	15	0	0	15	0,059	12,5	NP
<i>Cercopithecus sp</i>	25	0	0	0	360	0	338	1055	0	1778	7	50	NP
<i>Colobus angolensis</i> (P.Sclater, 1860)	0	1	81	0	0	14	0	165	840	1101	4,33	50	PP
<i>Colobus sp</i>	0	13	35	0	111	0	0	0	0	159	0,62	17,5	PP
<i>Lophocebus albigena</i> (Gray, 1850)	4	38	5	23	0	0	0	0	453	523	2,06	62,5	NP
<i>Pan paniscus</i> (Schwarz, 1929)	0	0	0	0	0	0	0	3	0	3	0,01	12,5	TP
<i>Pan troglodytes</i> (Blumenbach, 1776)	0	0	0	0	65	22	0	209	168	464	1,82	17,5	TP
<i>Papio anubis</i> (Lesson, 1827)	9	18	0	2	15	9	22	21	260	356	1,4	87,5	NP
<i>Gorilla gorilla</i> (Savage, 1847)	0	0	0	0	0	1	0	0	0	1	0,003	12,5	TP
<i>Ptilocolobus badius</i> (Kerr, 1792)	0	137	91	17	0	114	0	0	1108	1535	6,046	62,5	PP
<i>Cercocebus galeritus</i> (Peter, 1879)	0	0	1	0	0	0	0	0	0	1	0,004	12,5	NP
Other Primates non identify	442	1676	3972	1004	360	0	0	0	0	7454	29,3	62,5	
Total per year	739	3058	5610	2015	1303	1382	824	4543	5843	25385			

A total of 25385 occurrences recorded over 8 years of study for which data are available. The first observation is that we note a large majority of primate trade. 29,3% of

them are not well identified due to the mode of conservation of the specimens. Smoking of specimens destroys essential hairs for species identification. Among

fresh specimens identified, *Cercopithecus ascanius* predominates in relative abundance with 26.7%, followed by *Cercopithecus mitis* *Cercopithecus ascanius*, *Cercopithecus hamlyni*, *Cercopithecus hoesti*, *Cercopithecus mitis*, *Cercopithecus neglectus*, *Cercopithecus mona*, *Colobus angolensis*, *Lophocebus albigena*, *Papio anubis*, *Procolobus badius* 6.68%, *Cercopithecus the hoesti* 6.39% and *Procolobus badius* 6%. Blackcurrants, baboons, gorillas and bonobos are less abundant on the bushmeat market in Kisangani.

Table (1) shows 11 species of monkeys constant on the market with a coefficient greater than or equal to 50%.

These are *Cercopithecus ascanius*, *Cercopithecus hamlyni*, *Cercopithecus the hoesti*, *Cercopithecus mitis*, *Cercopithecus neglectus*, *Cercopithecus mona*, *Colobus angolensis*, *Lophocebus albigena*, *Papio anubis*, *Procolobus badius*. Other remaining monkey species listed in the table are classified as accidental with less than 25% constancy.

About the status of the species, 12.85% of the volume of monkey game sold is composed of protected species (3263 occurrences, including 2795 cases for partially protected species and 468 cases for totally protected species).

Table.2: Artiodactyla commercialization in Kisangani

Species	Banamuhere	Wetsi	Biya	Gambalemoke	Belembo	Sakananu	Nebesse	Nebesse	Kaswera	Total	RA %	Constancy (%)	Statut
	1976	1981	1983	1989	1997	2006	2014	2016	2016				
<i>Cephalophus dorsalis</i> (Gray, 1846)	10	121	226	82	724	292	189	1546	1689	4879	11.7	100	NP
<i>Philantomba monticola</i> (Thunberg, 1789)	2943	7937	5339	1280	1298	326	145	1636	1676	22580	54.4	100	NP
<i>Cephalophus nigrifrons</i> (Gray, 1871)	15	13	10	6	861	141	45	688	709	2488	5.99	100	NP
<i>Cephalophus sylvicultor</i> Afzelius, 1815	0	1	0	2	60	13	8	10	438	532	1.28	75	PP
<i>Cephalophus callipygus</i> (Peters, 1876)	0	1	0	4	0	0	0	0	0	5	0.01	25	NP
<i>Cephalophus leucogaster</i> J.E.Gray 1873	0	0	0	2	0	0	0	0	1182	1184	2.85	25	NP
<i>Cephalophus sp</i>	0	0	0	0	0	0	0	287	0	290	0.7	12.5	NP
<i>Hyemoscus aquaticus</i> (Ogilby, 1841)	3	33	5	74	114	52	4	138	319	742	1.79	100	TP
<i>Tragelaphus spekei</i> Sclater, 1864	6	32	9	11	63	17	13	73	400	624	1.5	100	PP
<i>Tragelaphus scriptus</i> (Pallas, 1766)	10	9	0	0	0	0	0	0	0	19	0.05	25	PP
<i>Syncerus caffer</i> (Sparman, 1779)	0	0	0	0	0	12	19	105	70	206	0.5	37.5	PP
<i>Okapia johnstoni</i> (P. L. Sclater, 1901)	0	0	0	0	0	0	3	0	0	3	0.01	12.5	TP
<i>Phacochoerus aethiopicus</i> (Pallas, 1766)	0	0	0	0	0	0	0	0	674	674	1.62	12.5	PP
<i>Potamochoerus porcus</i> (Linne, 1758)	16	23	60	13	103	80	70	595	1144	2104	5.06	100	PP
<i>Suidae non identify</i>	0	0	81	84	0	0	0	0	0	165	0.4	25	
<i>Artiodactyla non identify</i>	600	1928	581	1942	0	0	0	0	0	5051	12.2	50	
Total	3603	10098	6311	3500	3223	933	496	5078	8301	41543			

Table (2) shows 41543 occurrences recorded for Artiodactyls during the eight years of study. The most abundant species on the market in descending order are *Philantomba monticola* 54.4%, *Cephalophus dorsalis* 11.7%, and *Cephalophus nigrifrons* 5.99%. Unidentified specimens due to smoking mode of conservation account for 12.2% of the lot. Constant Artiodactyls species are *Philantomba monticola*, *Cephalophus dorsalis*, *Cephalophus nigrifrons*, *Cephalophus sylvicultor*, *Hyemoscus aquaticus*, *Tragelaphus spekei*, and

Potamochoerus porcus. The accessories species with constancy between 49 and 25% are *Cephalophus callipygus*, *leucogaster*, *Tragelaphus scriptus*, *Syncerus caffer*, and unidentified specimens of Suidae. The remaining species listed in Table (2) are accidentals with less than 25% consistency.

Artiodactyls protected species represent 11.8% of ungulates cargo sold during the study period. Totally protected species is about 754 occurrences and partially protected 4159 cases.

Table.3: Rodent's bushmeat trade in Kisangani

	Banamuhere	Wetsi	Biya	Gambalemoke	Belembo	Sakananu	Nebesse	Nebesse	Kaswera	Total	RA %	Constancy (%)	Statut
Species	1976	1981	1983	1989	1997	2006	2014	2016	2016				
<i>Atherurus africanus</i> (Gray, 1842)	139	489	538	0	637	570	71	2028	2466	6938	21.44	87.5	NP
<i>Cricetomys emini</i> (Wroughton, 1910)	2190	8797	5080	635	151	1653	122	0	0	18628	57.59	87.5	NP
<i>Cricetomys gambianus</i> (Waterhouse, 1840)	0	0	0	0	0	183	0	1761	4682	6626	20.48	25	NP
<i>Trionomys swinderianus</i> (Fitzinger, 1867)	0	0	0	0	0	0	10	39	105	154	0.47	25	NP
Total	2329	9286	5618	635	788	2406	203	3828	7253	32346			

The copulation of market investigation data stipulates 32,346 cases of rodents sold. *Cricetomys emini* predominates from the point of view of relative abundance with 57.5% followed by *Atherurus africanus* 21.44%, *Cricetomys gambianus* 20.48%. Two constant

species namely *Atherurus africanus*, *Cricetomys emini* and two accessories *Tryonomys swinderianus* and *Cricetomys gambianus* with 25%. No protected species of rodents have been inventoried.

Table.4 : *Pholidota* trade bushmeat in Kisangani

	Belembo	Nebesse	Nebesse	Kaswera	Totaux	RA (%)	Constancy (%)	Statut
Species	1997	2014	2016	2016				
<i>Phataginus tricuspidis</i> (Rafinesque 1821)	0	2	0	39	41	7.63	25	PP
<i>Phataginus tetradactyla</i> (Linnaeus, 1766)	0	0	12	0	12	2.23	12.5	PP
<i>Smutsia gigantea</i> (Illiger, 1815)	2	8	117	357	484	90.13	37.5	TP
Totaux annuels	2	10	129	396	537			

The giant pangolin is the most abundant with 90.13%; followed by Phataginus tricuspis. Although protected, two species are accessory and an incident with 12.5% constancy.

Table.5 : Hyracoidea bushmeat trade in Kisangani

	Nebesse	Kaswera	Total	RA (%)	Constancy (%)	Statut
Species	2016	2016				
Dendrohyrax dorsalis (Frase, 1855)	279	0	279	64.88	12.5	NP
Dendrohyrax arboreus (A. Smith 1827)	0	151	151	35.12	12.5	NP
Total	279	151	430			

Both species of Hyracoidea are accidental on the market.

Other groups such as Elephant and Tubilidentes are less abundant as shown in tables (6 and 7).

Table.6: Elephant bushmeat trade in Kisangani

	Sakananu	Nebesse	Kaswera	Total	RA (%)	Constancy (%)	Statut
Spece	2006	2014	2016				
Loxodonta africana (Blumenbach, 1797)	64	2	322	388	100	37.50	TP

388 elephant meatsheet

Table.7: Tubilidentes bushmeat commercialization in Kisangani

	Sakananu	Nebesse	Nebesse	Kaswera	Total	RA (%)	Constancy (%)	Statut
Spece	2006	2014	2016	2016				
Orycteropus afer (Pallas, 1766)	9	6	14	26	55	100	37.50	TP

Table.8: Carnivora bushmeat commercialization in Kisangani

	Banamuhere	Belembo	Nebesse	Kaswera	Total	RA %	Constancy (%)	Statut
Espèces	1976	1997	2016	2016				
Aonyx congicus (E. Lonnberg, 1910)	1	0	0	0	1	0.17	12.5	NP
Osbornictis piscivora J. A. Allen 1919	0	0	0	440	440	73.21	12.5	TP
Bdeogale nigripes (Pucheran, 1855)	0	1	159	0	160	26.62	25	NP
Total	1	1	159	440	601			

Big game is rare, new species like *Osbornictis piscivora* are currently targeted for sale the same for bats.

Table.9: Chiroptera commercialization in Kisangani

Species	Belembo	Ndjoku	Nebesse	Musaba	Total	RA (%)	Constancy(%)	Statut
	1997	2011	2016	2016				
<i>Eidolon helvum</i> (Kerr, 1792)	235	2487	861	3034	6617	76.9	37.5	NP
<i>Epomops frangeti</i> (Tomes, 1860)	235	280	93	15	623	7.25	37.5	NP
<i>Hypsignathus monstrosus</i> (Allen, 1861)	235	483	106	147	971	11.3	37.5	NP
<i>Rousettus aegyptiacus</i> (Geoffroy, 1810)	0	315	0	19	334	3.8	25	NP
<i>Myonycteris torquata</i> (Dobson, 1878)	0	0	0	51	51	0.59	12.5	NP
Total	705	3565	1060	3266	8596			

More than 8596 bats were sold in Kisangani during the study period. Bat species with considerable biomass dominate relative abundance. This is the case of *Eidolon helvum* (76.9%), *Hypsignathus monstrosus* (11.3%). From the point of view of constancy, four species proved to be accessory and accidental.

Table.10: Global occurrences per animal groups

	Species number and statut	Occurrences Non protected species	%	Occurrences protected species	%
Primates	11 NP and 6 P	25385	23.31	3263	35.47
Artiodactyla	5 NP and 8P	41543	38.15	4904	53.31
Rodentia	4 NP	32346	29.70	0	0
Pholidota	3P	0	0.00	537	5.84
Hyracoidea	2 NP	430	0.39	0	0
Carnivora	2 NP and 1 P	601	0.55	440	4.78
Tubilidentata	1P	0	0.00	55	0.6
Elephantidae	sheet	0	0.00	388 sheet	
Chiroptera	5 NP	8596	7.89	0	0
Total		108901		9199	

A total of 08901 occurrences were highlighted. Considering the occurrences by group, we find ourselves in front of a rather shocking situation with 53.3% of ungulates protected, 35.47% of protected primates, pangolins and small carnivores marketed for their meat.

V. DISCUSSIONS AND CONCLUSIONS

The study focused only on game birds regularly marketed in urban and rural markets of Kisangani as a source of protein and therefore for food purposes. Based on the previous work on this trade the study wants to appreciate the constancy of the species and to follow the evolution of the sales in recent years. It reveals 118090 specimens belonging to about forty species. The species fully

protected by Congolese law are reported on the markets with 9199 cases or 8.44%. These include pangolins, aardvark, water snappers, wild pigs, tragelaphes, buffaloes, colobus, chimpanzees, bonobos, gorillas, okapis and elephants. Basa *et al.*, (2017) pointed to non-compliance with regulations in this sector. The Artiodactyls predominate in terms of relative abundance (38.15%) followed by rodents (29.7%), Primates (23.3%), and Chiroptera (7.89%). Pangolins represent 5.84%, Carnivores (4.78%), Aardvark (0.6%), Hyracoides (0.39% damans) and 388 pieces of elephants.

Belembo *et al.*, (2003) state that the examination of 5662 carcasses inventoried at the Kisangani market indicated that the Artiodactyls (*Philantoma monticola*, *Cephalophus nigrifrons*, *Cephalophus dorsalis*), the Primates (*Cercopithecus ascanius*, *Cercopithecus mitis*, *Cercopithecus hamlyni*, *Cercopithecus l' hoesti*) and rodents (*Atherurus africanus*, *Cricetomys emini*) were, in order of importance, the most popular game. They had counted about twenty species of Mammals except the Cercopithecus that were not be observed.

Van Vliet *et al.*, (2012) in a study of the bushmeat trade in Kisangani reported 18 species recorded in 2002 and 22 species in 2008-2009. They estimated rodents and ungulates at 78% for 2002 and 68% for 2008-2009. The number of carcasses had increased by 44% between 2002 and 2009. We note that the climb continues until these days.

Constant species in markets with constancy over 50% are highly valued by the population and contribute enormously to diet and protein balance in many families in Kisangani City. Their price and the high demand depend as well on their fresh quality as on the preference of the consumers. For Artiodactyls, It is: *Philantomba monticola*, *Cephalophus dorsalis*, *Cephalophus nigrifrons*, *Cephalophus sylvicultor*, *Hyemoscus aquaticus*, *Tragelaphus spekei*, *Potamochoerus porcus*. For Primates: *Cercopithecus ascanius*, *Cercopithecus hamlyni*, *Cercopithecus hoesti*, *Cercopithecus mitis*, *Cercopithecus neglectus*, *Cercopithecus mona*, *Colobus angolensis*, *Lophocebus albigena*, *Papio anubis*, *Piliocolobus badius*.

About Rodents, we mention *Atherurus africanus* and *Cricetomys emini*. Species not listed are either incidental or incidental.

The observation made when monitoring species per year is that some species have almost disappeared from the market over time (the case of the Cercopithecus); on the other hand, many have seen a considerable rise. This is justified by the growing demand for meat and consequently the gradual disappearance of food taboos and taboos in Kisangani, a city where the mixing of cultures and traditions within communities is becoming more and more felt.

The constant species, on the other hand, are either very prolific, occupy several ecological niches or even post-disturbed habitats or are easily captured by hunters.

However, the market for game continues to evolve, as the results show new species inventoried for the first time such as *Osbornictis piscivora* which did not have a considerable market value formerly, *Tryonomys* or grasscutters are savannah and invade progressively degraded forest areas.

Gorillas and most protected species are sold in secret and thus difficult to be inventoried by the investigators. A final explanation is that the identification of species has improved a lot compared to the last ten years including capitalizing the DNA analysis of the tissues from the game. The study conducted by Dimitri (2014) reports on the diversity of species involved in the bushmeat trade in the Kisangani region by means of DNA barcodes of the fragmented mitochondrial DNA cytochrome c oxidase subunit I (IOC) and cytochrome b. An identification success rate of 65% was achieved through the study associated with vernacular names in local languages.

Given the results copied in this study, we conclude that the levies and charted demand of the wild sheptel continues to grow. Some species have disappeared from the sales channel or have seen their numbers increase in recent years; new species had a considerable score.

Thus, the pressure exerted on all species sold without any exception is a danger to their sustainability and has a galloping pace over the last decade. Species are exploited regardless of their protection status.

Efforts should be made at all levels for the protection and conservation of biodiversity, and studies are continuing to ensure statistics on the exploitation of wild sheptel, such as the volume of meat sampled annually, their densities and the dynamics of the species. populations in the forest. Reconcile supply and demand; otherwise overexploitation will result in the local disappearance of certain species.

Promote and ensure the development of alternative protein resources such as fish farming, poultry farming, and domestication of highly valued wildlife species.

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